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THE DREO FABRIC WEAR AND DESIGN COURSE. (U)  
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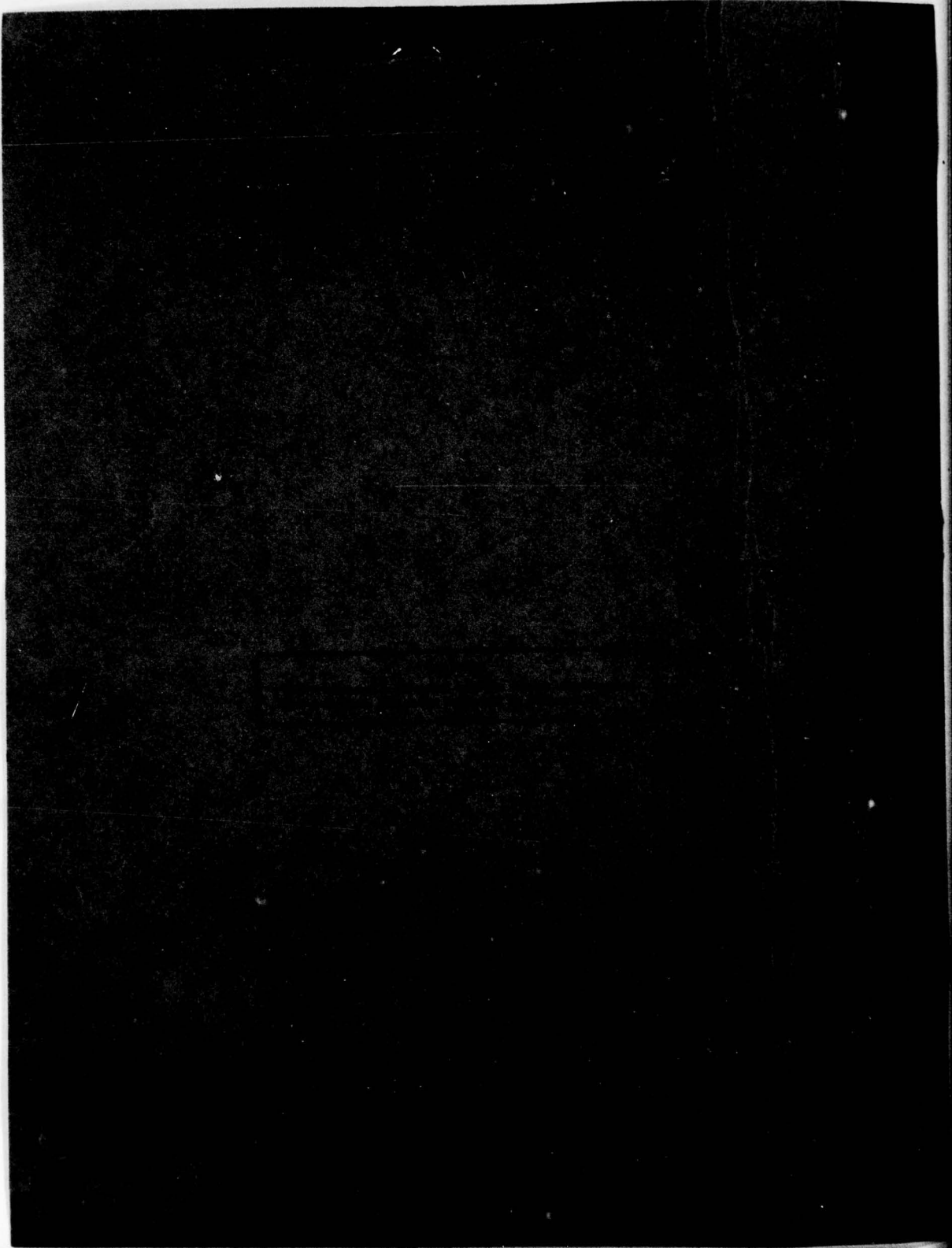
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THE DREO FABRIC WEAR AND DESIGN COURSE.

by

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ABSTRACT

A brief general description of the DREO field facility for evaluating clothing together with a number of photographs which describe the component sections of the testing course in detail is given. Its purpose is to acquaint those who may have a requirement for testing of this nature with the existence and characteristics of the course.

RÉSUMÉ

Brève description d'ensemble des services d'évaluation des vêtements par DREO, accompagnée de photographies illustrant de façon détaillée les divers éléments du cours. Le but est de porter l'existence de ce cours à la connaissance de tous ceux qui pourraient avoir besoin d'essais de ce genre, et de leur en indiquer les caractéristiques.

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## INTRODUCTION

One of the more important stages in the design and development of military clothing and personal equipment is the scientific evaluation of prototype garments when worn by potential users under realistic field conditions. Military clothing and equipment usually must be designed to withstand greater strain than similar civilian items and if failures do occur in a military situation, the consequences may be serious. Testing to ensure reliability is important. Thus, before a new item of clothing is introduced into the Canadian Forces, small numbers of the proposed item are subjected to extensive testing to determine whether or not the item meets all requirements.

Clothing evaluations are usually conducted by having a small number of test subjects wearing the garments of interest perform standardized activities in order to assess design features such as proper sizing to permit freedom of movement, ease of donning and doffing and comfort afforded. Other aspects which might be investigated include durability of seams under stress or location of pockets and closures regarding ease of access, etc. Especially in military clothing, such features are as important as the proper selection of the materials used in the clothing. Standardized realistic test conditions usually take the form of a series of obstacles over which test subjects run, jump and crawl a number of times in order to stress the clothing which they are wearing. Evaluations of this nature may also be used to provide accelerated wearing of the materials themselves under realistic conditions.

Since it is difficult to obtain absolute measurements, the testing of prototype clothing is usually done comparatively, using clothing with known characteristics as well as the test clothing. The evaluation of prototype clothing using the field facility described in this paper includes objective measurements as well as subjective measurements. Usually both the wearers and the scientific observers comment on performance. Questionnaires, carefully designed to obtain the maximum information from the test subjects are usually used.

## GENERAL DESCRIPTION OF TESTING FACILITY

The DREO Fabric Wear and Design Course is a field facility situated in a remote location about five miles from the main Shirley Bay laboratory.

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It comprises two distinct testing courses (the Fabric Wear Course and the Design Course) each of which consists of a selection of different obstacles designed to simulate various physical situations which may be encountered by soldiers during military field activity. Soldiers wearing specific items of clothing and equipment move over or through selected sets of obstacles a number of times subjecting the test items to different types of abrasion and stress which may cause wear or failure of the items. Such tests normally will reveal in a relatively short period of time superiorities or deficiencies which may exist in the test items.

The Fabric Wear Course is designed to provide controlled accelerated wearing of the various fabrics and materials used in items of military clothing. Test subjects wearing the clothing of interest crawl, slide and climb over a series of 29 obstacles which have been constructed using materials such as wood, concrete, sand and gravel to test the durability of the materials used in the clothing. Each of the obstacles is described in detail later. Trousers probably receive the greatest wear of any of the garments subjected to this course so the most effective means of evaluating a test fabric in this manner is to manufacture trousers using the test material. Wear is measured by inspecting the test clothing after it has been subjected to the course a number of times and recording the size, number and location of tears, frays and holes together with possible reasons for failure.

The Design Course consists of a series of 10 obstacles (described below) constructed to provide a means of stressing items of clothing to evaluate design features such as seam strength or restrictions on freedom of movement imposed on test subjects wearing the clothing while performing specified manoeuvres. In contrast to the abrasion and wearing of fabrics caused by the obstacles of the Fabric Wear Course, the obstacles of the Design Course are used primarily to cause the test subjects to stretch and extend their arms and legs in various directions, imposing strain on the seams of the test clothing. In addition, the test subjects themselves are stressed so that any unnecessary encumbrances or restrictions caused by the clothing or equipment being evaluated are quickly manifested. Again, clothing degradation is measured by inspecting the test items after being worn on the course a number of times and recording size, number and location of and possible reasons for any failures observed.

Obviously, in any given trial or evaluation, it is not necessary to utilize all of the obstacles available at either of the testing courses. Obstacles may be selected individually or in combination to assess specific functions of the clothing or equipment being evaluated. Similarly, wear is not the only criterion which may be used to evaluate performance. The length of time required for test subjects to complete the course or portions of it may also be used as a measure of the restrictions imposed on the subjects by experimental clothing and equipment. Usually when time is used, experimental items are tested in comparison with standard or control items and one determines percentage improvement or deterioration caused by the test item.

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The DREO course is situated on mainly sandy soil in a clearing surrounded by a heavily wooded area. The type of soil is ideally suited for conducting trials which involve tasks such as jumping or digging trenches. Reference 1 describes a field trial, part of which was conducted at this test site, where subjects shovelled measured quantities of sand in a specified period of time as part of an experiment to evaluate physiological heat stress imposed by protective overgarments. The site can also be used for conducting many of the exercises such as digging, high jumping and long jumping specified in the NATO Triptique for the evaluation of NBC protective clothing (2). Descriptions of other testing techniques and courses similar to the DREO Fabric Wear and Design Course for the testing of clothing and equipment ensembles may be found in references 3-6.

The testing course has been in existence at DREO for a number of years and was recently refurbished. The primary purpose of this technical note is to make the facility known to those who may have a requirement for testing of this nature but who previously may have been unaware of its existence.

The remainder of this paper consists of a number of photographs showing the various obstacles in the testing courses. The wooden stick carried by the test subjects in the photographs is used to simulate carrying a rifle. Where necessary, individual obstacles are described in detail in the captions. Figures 1 to 29 illustrate the obstacles which make up the Fabric Wear Course and Figures 30 - 39 illustrate those of the Design Course. Figure 40 is a diagram of the overall site plan.



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*Fig. 1 - Sand Cover, 6 x 3 m. Subject traverses the length of the obstacles, crawling on stomach (Leopard Crawl).*



*Fig. 2 - Sand Cover, 11 x 3 m. Subjects crawl on hands and knees.*





*Fig. 3 - Sand Cover, 9 x 3 m. Subjects execute leopard crawl.*



*Fig. 4 - Vertical Wall, 0.9 m wide x 3 m high, made of 21-cm-high concrete blocks set in 4-cm steps. Subject climbs wall to top of small hill, rubbing clothing on concrete.*



*Fig. 5 - Railway Ties, 1.5 x 1.7 m. Subject crawls over rails under barbed wire suspended 0.4 m above ground.*



*Fig 6 - Stone Ramp, smooth stones approx. 18 cm. diameter embedded in concrete 3.3 x 2.4 m. Subject slides headfirst down 60° ramp on stomach.*





*Fig. 7 - Sand Cover, 6 x 3 m. Subject traverses the length of the obstacle crawling on back.*



*Fig. 8 - Hurdle, smooth concrete wall 1.5 x 0.2 x 0.5 m. high.  
Subject crawls over, rubbing clothing.*

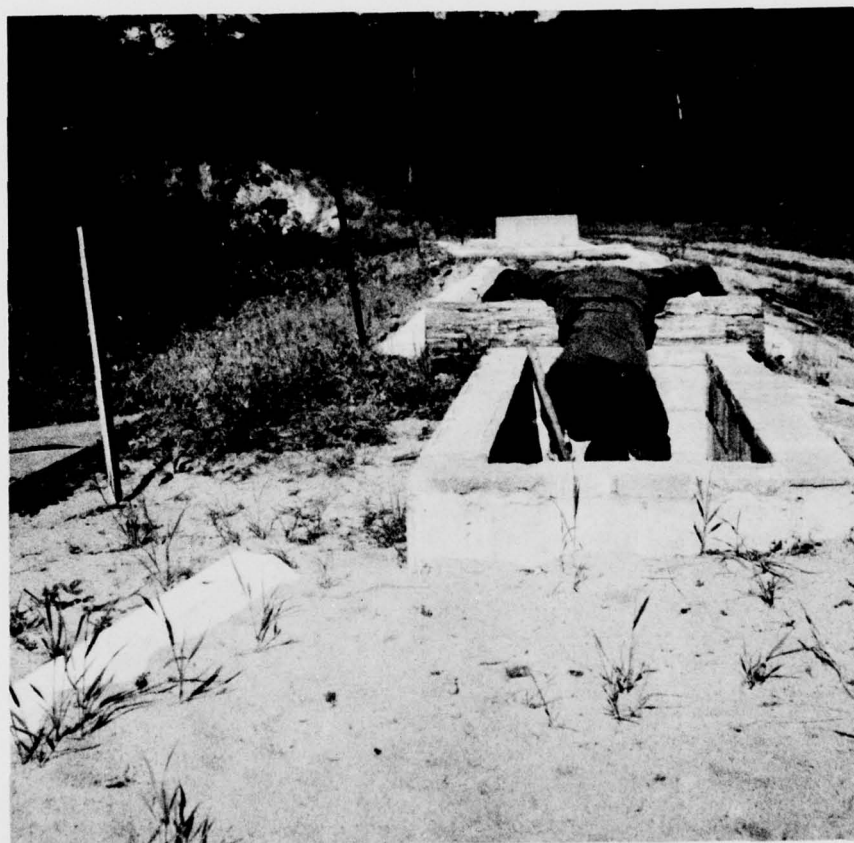


*Fig. 9 - Sand Cover, 10 x 5m. Subjects traverse crawling on hands and knees.*

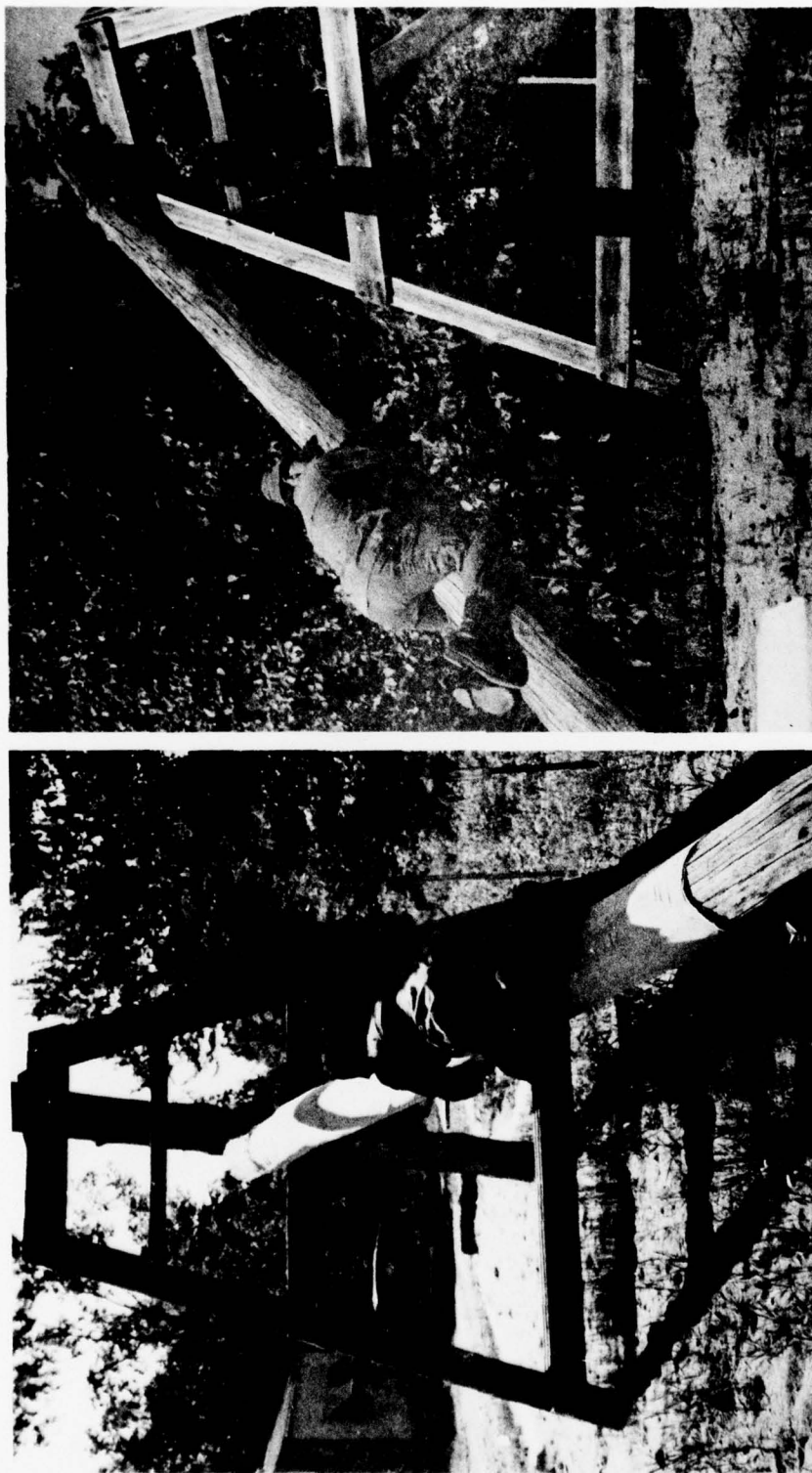




*Fig. 10 - Sand Cover, 9.5 x 1.5 m. Subjects traverse crawling on back.*



*Fig. 11 - Concrete Block Pit, concrete block walls with earth floor, 2.4 x 0.8 x 0.9 m deep. Subjects crawl in and out.*



(a) approach  
Fig. 12 - Inclined Log Bridge, two 10-cm-diameter logs approx. 4.5 in length, inclined at 35° and 50°. Subjects climb up approach which is covered with canvas and slide backwards down second log (uncovered).  
(b) descent



*Fig. 13 - Sand Cover, 7 x 1.5 m. Subjects traverse using leopard crawl.*



*Fig. 14 - Gravel Cover, 11 x 1.5 m, 3-cm-dia. gravel. Subjects traverse using leopard crawl.*





*Fig 15 - Sand Cover, 27 x 2 m. Subjects crawl on hands and knees.*



*Fig 16 - Log Hurdle. Subjects crawl over hurdle 1.2 m high made of split logs 15-cm dia. x 2 m long.*





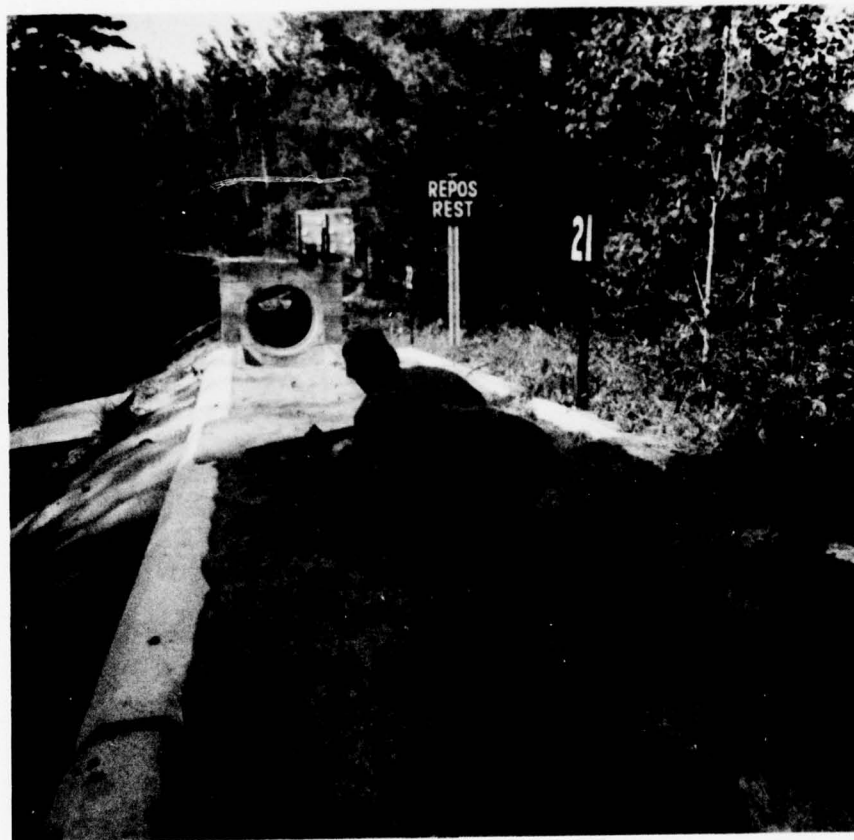
*Fig. 17 - Sand Cover, 5 x 1.6 m. Subjects traverse using leopard crawl.*



*Fig. 18 - Sand Cover, 9 x 1.5 m. Subjects crawl on hands and knees.  
(Obstacle 19 is similar to Obstacle 18).*



*Fig. 20 - Pill Box, 1.7 x 1.1 x 0.6 m high, covered in smooth 10-cm-dia. stones set in concrete. Subjects crawl over on stomach.*



*Fig. 21 - Sand Cover, 7 x 1.2 m. Subjects traverse using leopard crawl.*



*Fig. 22 - Concrete Block Pit, concrete block walls with earth floor, 1.8 x 0.8 x 0.7 m deep. Subjects crawl in and out.*



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*Fig. 23 - Pipe Crawl. Subjects crawl through concrete pipe 0.6 m dia., 5 m long.*

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*Fig. 24 - Sand Cover, 11 x 2 m. Subjects traverse crawling on back.*



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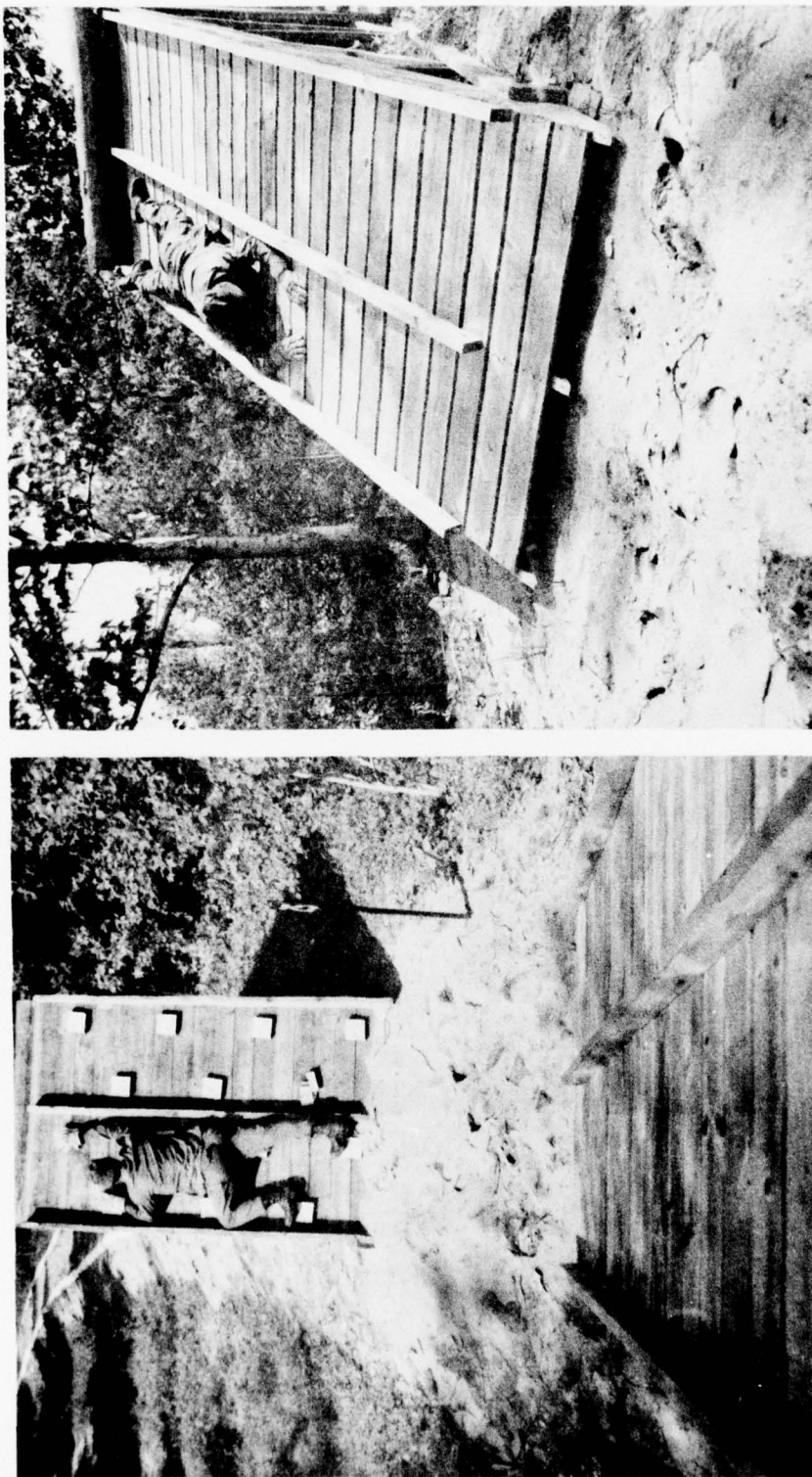
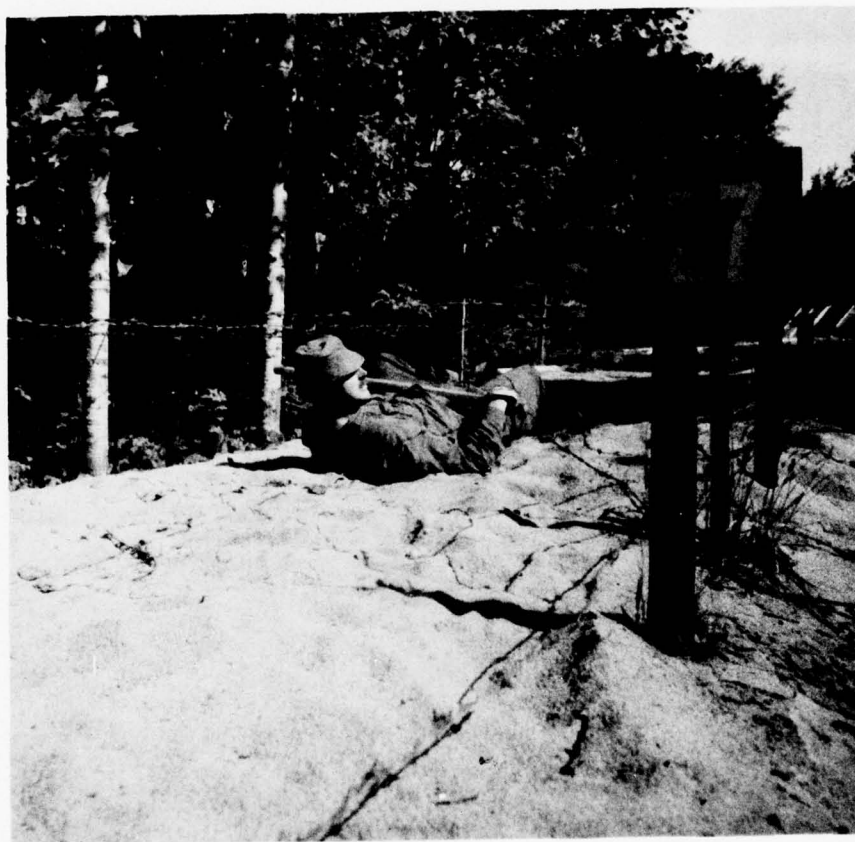


Fig. 25 - Wooden Ramps. Two ramps separated by 2 m of sand cover with faces of dressed lumber  $2.4 \times 1.7$  and  $3.7 \times 1.7$  m and inclined at  $45^\circ$  and  $75^\circ$  respectively. Subjects crawl up first face which has 14-cm-square wooden blocks to assist climbing and slide down second face head first.

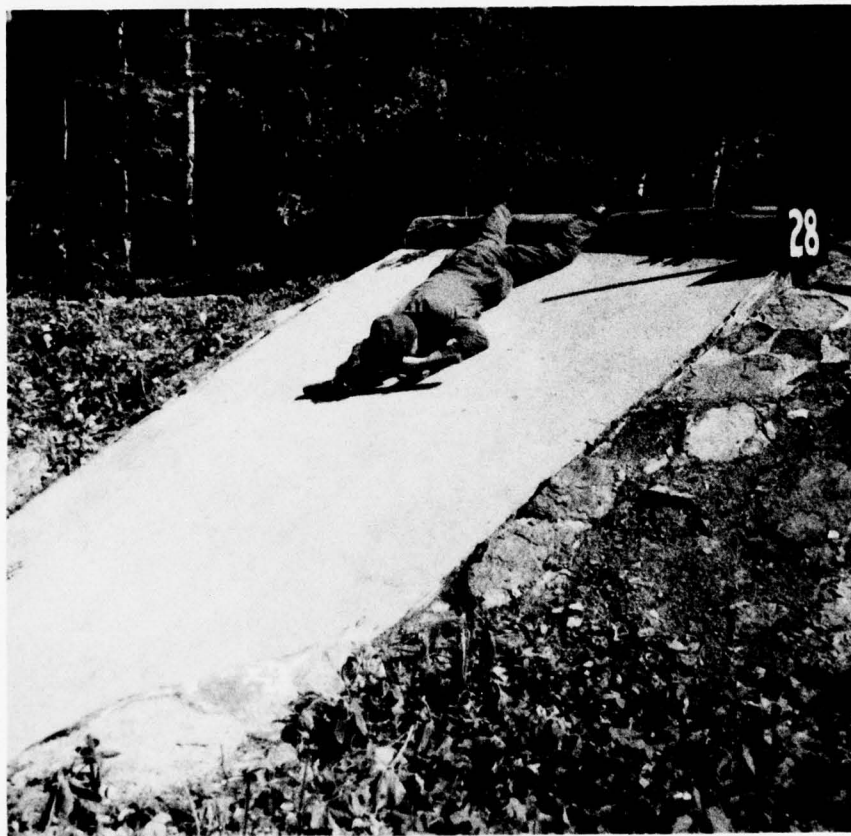
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*Fig. 26 - Sand Cover, 52 x 2 m. Subjects crawl on hands and knees.*

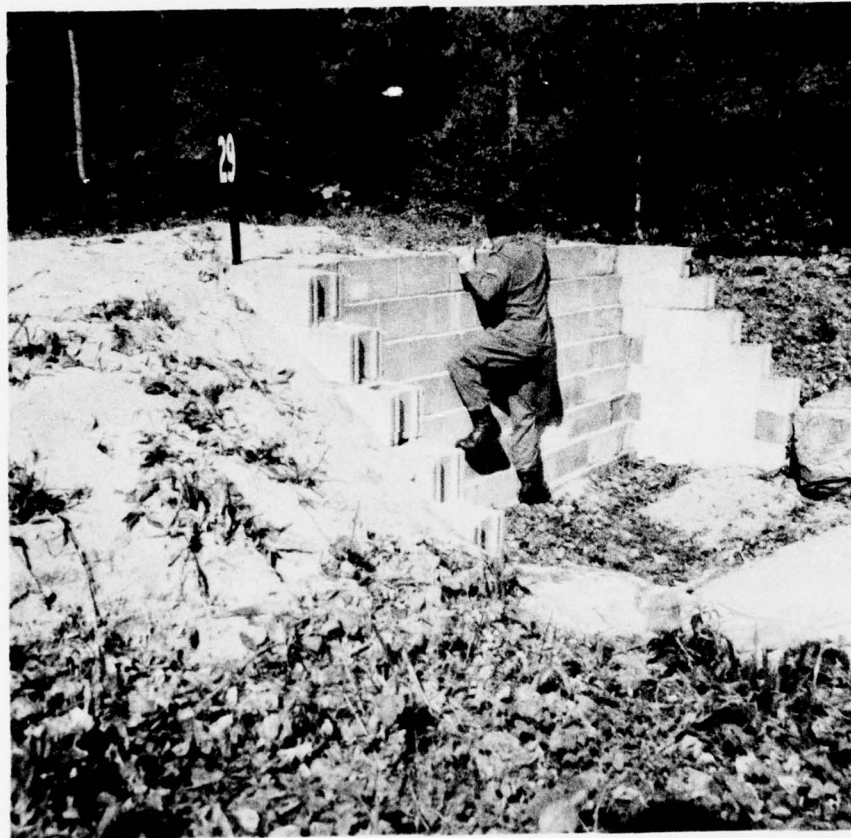


*Fig. 27 - Sand Cover, 6 x 2.2 m. Subjects crawl on back under barbed wire suspended 45 cm above ground.*



*Fig. 28 - Concrete Ramp, smooth concrete 3.6 x 2.6 m inclined at 45°. Subjects slide down on stomach head first.*





*Fig. 29 - Vertical Wall. Seven courses of concrete blocks set in 4-cm steps forming a wall 2.9 x 1.5 m high. Subjects climb up, rubbing clothing.*





*Fig. 30 - Low Hurdle - a series of five wooden hurdles, 0.8 m high, spaced 4.5 m apart. Subjects step over each in turn stretching and stressing seam in crotch of trousers.*



*Fig. 31 - Straddle Run - 12 automobile tires placed in a zig-zag pattern with centers approx. 1.5 m apart. Subjects run through obstacles placing feet alternately in centre of tires.*



*Fig. 32 - Overhead Ladder - ladder 4.6 m long, suspended 2.8 m above the ground with rungs 30 cm apart. Subjects mount wooden platform 1 m above ground at end and traverse the ladder swinging from hand to hand. Tests armpit & shoulder seams.*



*Fig. 33 - Concrete Block Wall 2.5 x 1.7 x 0.3 m. Subjects climb over, stretching seams and rubbing clothing.*





*Fig. 34 - Rope Swing - 5 cm dia. x 9 m long manilla rope suspended from a support 7.6 m above ground. Subjects swing across a sand pit 3.4 x 2 x 1.4 m deep.*

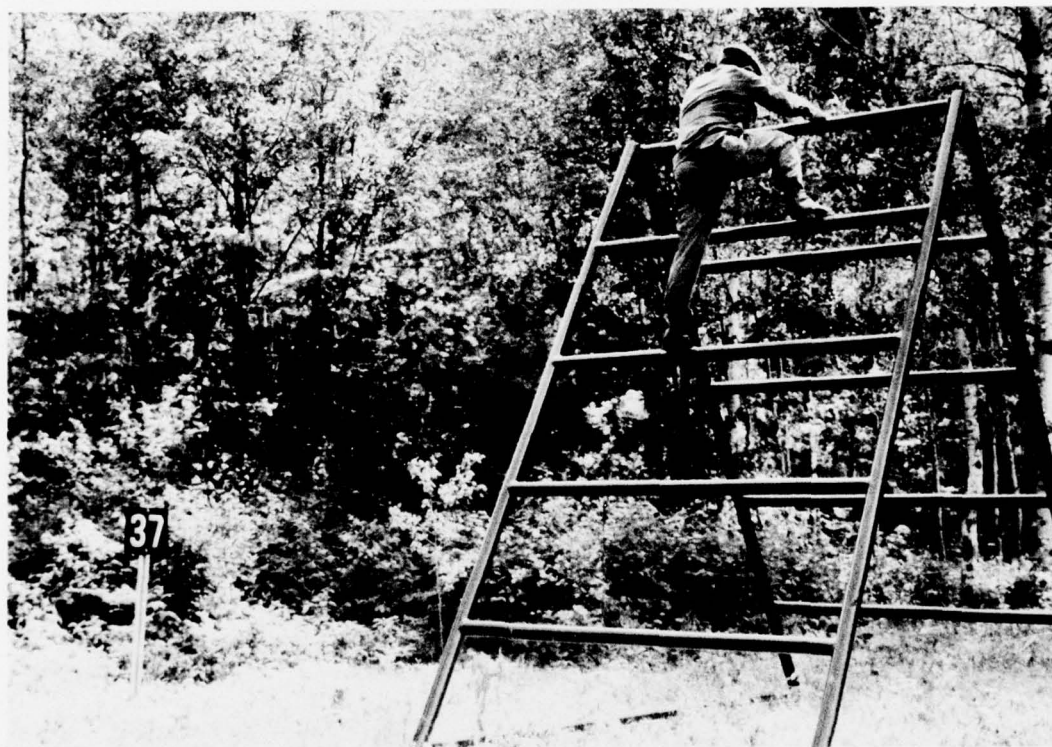




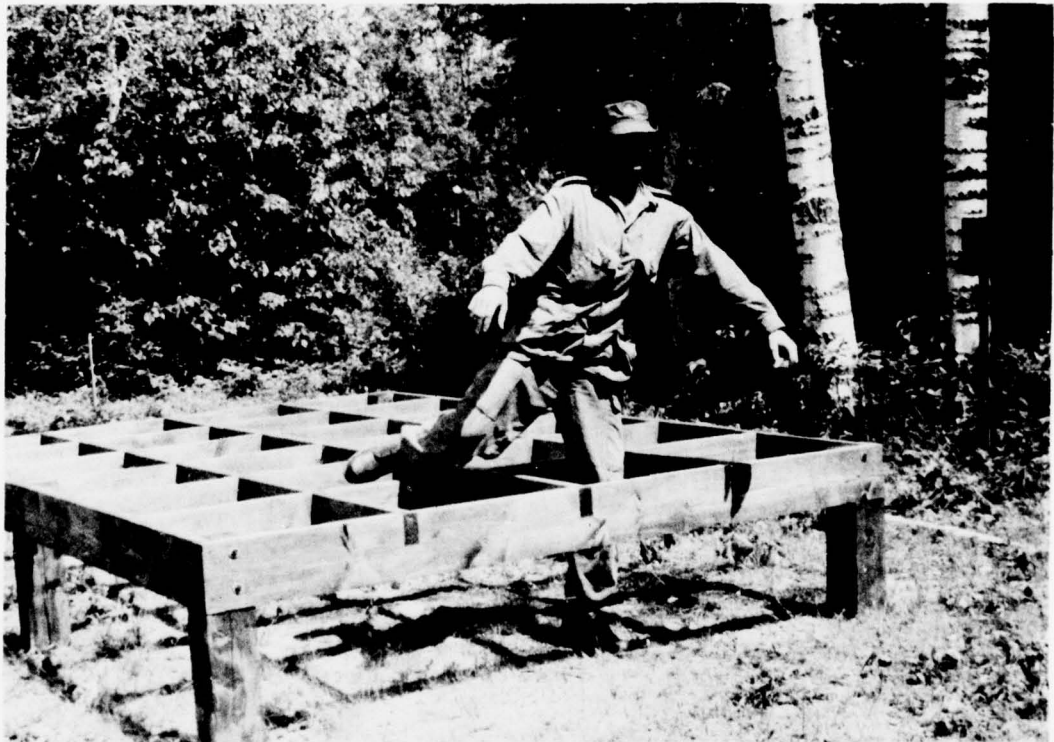
*Fig. 35 - Scramble Net, 1.8 x 3.4 m high, made of 1.6-cm-diameter polyester rope in an 18-cm-square mesh. Subjects climb up one side and down the other.*



*Fig. 36 - High Hurdle, 2.6 x 2.6 m, made of 15-cm-diameter logs. Two logs are positioned horizontally 1.4 m and 2.6 m above ground level. Subjects climb over.*

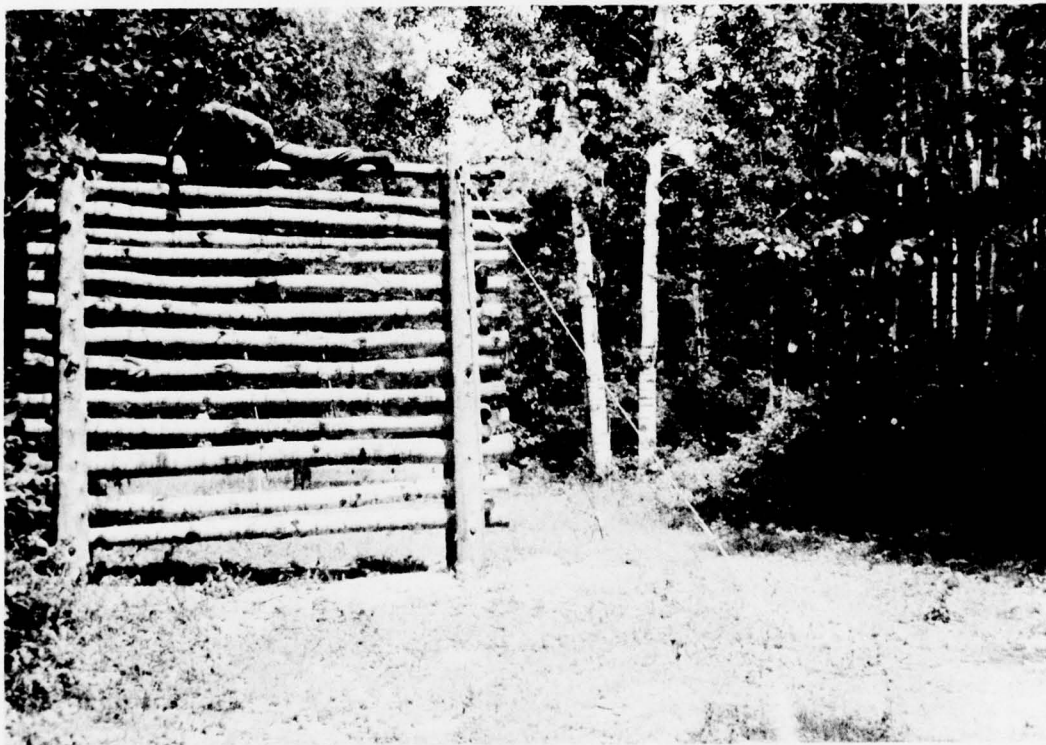


*Fig. 37 - Pipe Ladder. Metal pipes arranged to form a stepladder with sides 3.7 m. Rungs are 0.8 m apart. Subjects climb over.*



*Fig. 38 - High Step Grid. Wooden grid 3.6 x 2.4 m, 0.6 m above ground. Subjects step in alternate 0.6 m squares.*





*Fig. 39 - Log Wall, 2.7 x 3.1 m high made of 18-cm-diameter logs.  
Subjects climb over.*



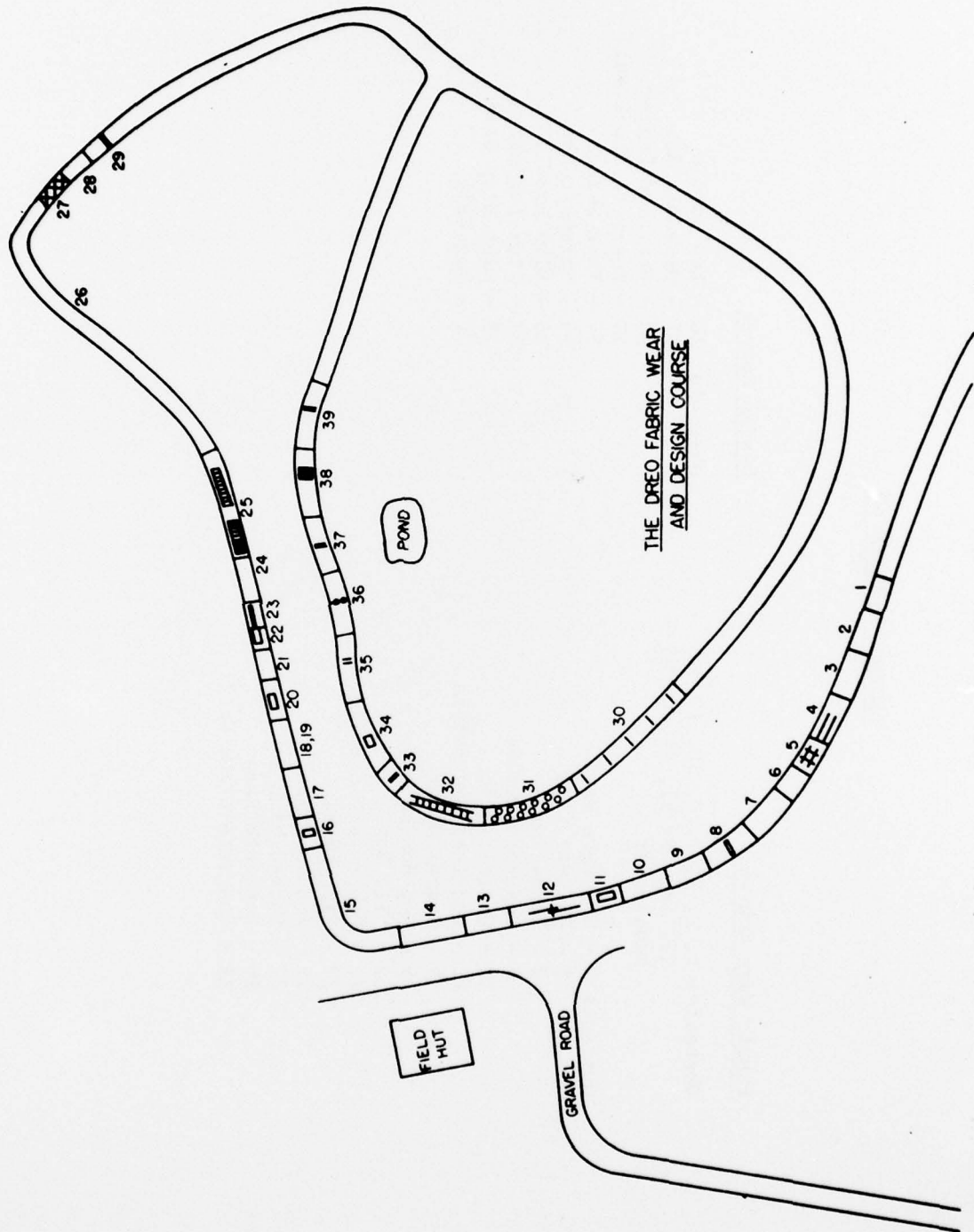


Figure 40. Site Layout: The DREO Fabric Wear and Design Course.

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LEGEND - FIGURE 40

<u>Fabric Wear Course</u>	<u>Design Course</u>
Obstacles 1, 2, 3, 7, 9, 10, 13, 15, 17, 18, 19, 21, 24 and 26 - sand cover.	Obstacle 30 - Low Hurdle 31 - Straddle Run 32 - Overhead Ladder 33 - Concrete Block Wall 34 - Rope Swing 35 - Scramble Net 36 - High Hurdle 37 - Pipe Ladder 38 - High Step Grid 39 - Log Wall
Obstacle 4 - Concrete Wall 5 - Railway Ties 6 - Stone Ramp 8 - Concrete Hurdle 11 - Concrete Pit 12 - Inclined Log Bridge 14 - Gravel Cover 16 - Log Hurdle 20 - Pill Box 22 - Concrete Block Pit 23 - Pipe Crawl 25 - Wooden Ramps 27 - Barbed Wire 28 - Concrete Ramp 29 - Concrete Block Wall	

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